

SECTION 4: ELECTRIC MOTOR & BATTERY RULES

4.0 Motors

Modified: Only brushed or brushless motors approved by IFMAR, ROAR EFRA & BRCA may be used.

4.0.1 **Brushed Motors:** *General definition of a Brushed Motor:*

4.0.2 Specifications; 05 sized displacement.

Can diameter to be a Maximum of 36.02mm

Can length to be maximum of 53mm measured from the mounting face of the motor to the furthest point not including solder, tabs or lead wires.

4.0.3 Current is supplied to the armature by two (2) brushes.

4.0.4 Armature – The rotor is to have three (3) poles with windings. Only copper wire is to be used.

No split rotors are allowed. The laminations have to be one on the other with nothing between. The thickness of the stack plates is 0.35mm +/- 0.05mm, a maximum of 63 laminations to be used.

The minimum stack thickness is 3.5mm

The Stack length without epoxy - minimum 21 mm and a maximum of 22.8mm.

Shaft diameter is .125 inch. Production tolerances allowed.

4.0.5 Ceramic magnets only (cobalt and rare earth magnets specifically not allowed).

4.0.6 Approved motors may be modified by re-winding, balancing, truing of commutators, epoxy, ball bearings, brushes and custom brush systems only.

4.0.7 Modifications to the original OEM/Manufacturer configurations, including but not limited to excessive drill holes, milling or turning to lighten the armature or enhance the performance of the full stack are not allowed.

4.0.8 No hybrid (mixing of parts from approved motors) allowed.

4.1.0 **Brushless Motors:** *General definition of a Brushless Motor:*

4.1.1 Sensored or sensorless motors are allowed.

4.1.2 The motor has to be rebuildable. Ball bearings are allowed.

4.1.3 **If the motor is sensored,** It Must use a six position JST ZH connector model number ZHR-6 or equivalent connector with 6 JST part number SZH-002T-P0.5 26-28 awg contacts or equivalent.

Wire sequence must be as follows:

Pin #1 - ground potential

Pin #2 - phase C

Pin #3 - phase B

Pin #4 - phase A

Pin #5 - temp control, 10 k Ohm Thermistor referenced to ground potential

Pin #6 - + 5.0 volts DC +/- 10%.

Compatible speed control must use the 6 position JST header part number X-6B-ZR-SMX-TF (where the X denotes the style of the header), or equivalent.

The power connector has to be clearly marked A, B, C.

A for phase A

B for phase B

C for phase C

4.1.4 **`05` size specifications**

Motor Can: Overall maximum diameter is 36.02mm measured at whatever point yields the maximum dimension, excluding solder tabs or lead wires. Overall minimum diameter is 34.00mm measured at whatever point yields the minimum dimension, excluding solder tabs or lead wires. Maximum length is 53.00mm measured from the mounting face of the motor to the furthest most point of the end bell, not including solder tabs, lead wires or original manufacturer's logo or name.

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Minimum length is 50.00mm measured from the mounting face of the motor to the furthest most point of the end bell, not including solder tabs, lead wires or original manufacturer's logo or name.

Motor mounting holes must be on 1.00- inch (25.40mm) centers.

Stack/Stator: Stack minimum length 19.30mm, maximum 21.00mm. Stack inside diameter minimum 12.50mm, maximum 16.00mm. If a stack is used then it must be continuous. The laminations have to be one after the other without anything in between. The thickness of the stack plates is 0.35 +/- 0.05mm. All laminations must be of the same material.

Winding: Only three slot (phase) "Y" wound stators are permitted. No delta wound stators allowed. Only circular (round) pure copper wire permitted. No turn limit.

Rotor: Shaft diameter must be 0.125 inches (3.175mm). Only one piece, 2 pole bonded Neodymium or Ferrite magnetic rotors are permitted.

Magnet minimum length - 23.00mm, maximum 27.00mm.

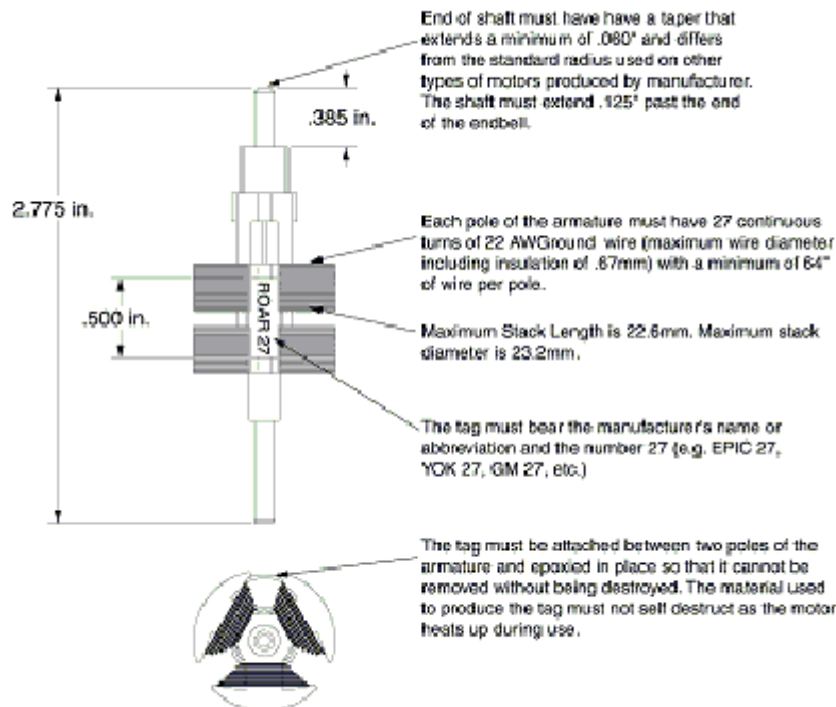
Magnet minimum diameter 12.00mm, maximum 15.50mm.

- 4.1.5 All motors must have the original manufacturer's logo or name moulded into the end bell.
- 4.1.6 No hybrid (mixing of parts from approved brushless motors) allowed.
- 4.2.0 **Stock Motors.** *General definition of a Stock Brushed Motor:*
Motors submitted for approval as rebuildable stock motors must have the manufacturer's name in the form of "XXXX 27" (e.g. EPIC 27, YOK 27, etc.) permanently stamped into the mounting face of the Motor Can. "XXXX 27" designates the use of the can for Stock class racing.
- 4.2.1 All rebuildable stock motors must be bushing-type with an end-bell that locks the timing at 24 degrees. The space between the magnets must be centered on one set of mounting holes, which will be marked on one side of the can to indicate zero degrees. The brush hoods will be aligned at 90 degrees from this mark, plus the allowed timing. The commutator slots must be aligned with the center of the armatures individual poles. A two-degree tolerance will be allowed on the commutator, but not on the overall timing. End-bell must include a mark indicating 24-degree timing adjustment when motor is assembled.
- 4.2.2 End-bell and Motor Can must be designed with a method of locking the timing at 24 degrees. This feature is in addition to any method, which secures the end-bell to the can (e.g., screws running through the side of the Motor Can). The end-bell must incorporate a molded tab that keys into a slot on the Motor Can — locking the timing at 24 degrees. End-bell timing may only be set at 24 degrees. Extra locking devices (e.g., extra notches in the Motor Can that allow timing to be changed to 36 degrees or 5 degrees) are not allowed.
- 4.2.3 End-bell may have inspection/cooling holes on each side between the negative and positive terminals. These holes would facilitate inspection of commutator tabs. End-bells must be marked with manufacturer's name.
- 4.2.4 The hole for the bushing in both the end-bell and the Motor Can, must be no smaller than .210" diameter. This will allow easy verification that the motor bushings have not been replaced with ball bearings and inspection will not require disassembly of the motor.
- 4.2.5 Motor Can must have inspection holes/slots between magnet tips so that the armature may be viewed for inspection of armature tag (see 5-39). These holes/slots may be no closer than .220" from the top or bottom edge of the Motor Can. View through inspection holes/slots must not be obstructed by anything covering the holes/slots (e.g. motor label).
- 4.2.6 Magnets must be permanently glued to the Motor Can and may not be removed. No magnet shims are allowed (e.g., an extra shim that could be added on the end of the magnet or between the tips to change performance). Flux collector/timing rings are allowed as long as their only purpose is to secure the end-bell to the Motor Can. Rings may not extend between magnet tips.
- 4.2.7 All rebuildable stock motor armatures must be wound using a "Mabuchi" cross wrap technique, and a process that locks the commutator and the armature stacks so that the timing cannot be changed without disassembling the motor. The legal stock wind is a minimum of 64 inches of round 22 AWG (American Wire Gauge) wire, having a maximum wire diameter (including insulation) of .67mm,

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resulting in no less than 27 continuous turns of wire on each pole. A production tolerance of one turn on one pole only is allowed. There is no tolerance, however, on the minimum length of wire, nor is there a plus tolerance allowed on the wire diameter.

- 4.2.8 Tabs on the armature's commutator may only be "compression welded". No after-market welding, silver soldering or brazing will be permitted.
- 4.2.9 Armature must be tagged in a way that it is easy to identify both in and out of the motor. The tag must be permanently affixed to the armature and made of a material that will not self-destruct from the heat of the motor or standard motor cleaning agents. The tag should be positioned between two poles of the armature and must be a minimum of .500" in length. The tag must be printed with the OEM manufacturer's name and "27" (e.g., "EPIC 27", "YOK 27", etc.).
- 4.2.10 Armature shaft must extend .125" beyond the end-bell bushing when motor is assembled. The overall length of the armature shaft should be 2.775" with .385" extending beyond the end of the commutator. The commutator end of armature shaft must be coned (tapered) and must differ from the standard radius currently used by OEM manufacturers in production of other motors. The taper should continue for a minimum of .060" from the end of the shaft.
- 4.2.11 No modifications to the physical construction of the Motor Can, end-bell, or armature will be permitted (e.g. adding or removing material from the armature stack, changing the brush hoods from stand up to lay-down and visa-versa, relocating spring posts). Epoxy balancing of armatures for rebuildable stock motors will not be permitted.
- 4.2.12 The armature, Motor Can, and end-bell of a rebuildable stock motor must all be from the same motor manufacturer and can contain only components from the same model. No hybrid motors or mixing of parts from different models will be permitted.
- 4.2.13 All non-rebuildable stock motors must remain in sealed condition. Any sign of tampering at locking tabs or end bell or any other modification will not be accepted at AARCMCC events.



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| Stock Motor List | | | |
|-------------------------------------|-------------|-----------|---|
| Rebuildable Stock | GM Racing | GM Racing | Pinnacle Gold Rebuildable Stock #GM9682 |
| Rebuildable Stock | GM Racing | GM Racing | Pinnacle Gold Rebuildable Stock #GM9682 |
| Rebuildable Stock | Orion | Orion | Chrome stock rebuildable w/ machined arm |
| Rebuildable Stock | Orion | Orion | "CORE" TOP27, Black Can, Gray Endbell,.300 comm., ldn br. |
| Rebuildable Stock | Reedy | Yokomo | Reedy Rebuildable |
| Rebuildable Stock | Reedy | Yokomo | "MVP" rebuildable Stock # 298-001 |
| Rebuildable Stock | Trinity | Epic | Paradox |
| Rebuildable Stock | Trinity | Epic | TM82B P2K Paradox 2k |
| Rebuildable stock | Trinity | Epic | Green Machine 3 |
| Rebuildable Stock | Trinity | Epic | TM 90 P2PK rebuildable stock |
| Rebuildable Stock | Trinity | Epic | TB-01 Monster Horsepower, Armature Tag Black Print |
| Rebuildable Stock | Trinity | Epic | Ep1111 Epic 27, Satin Bronze Can, 4x5 ldn brush, 0.300comm Armature Tag Black Print |
| Rebuildable Stock | Trinity | Epic | Ep1112 Epic 27, Satin Bronze Can, 4x5 ldn brush, 0.300comm, Armature Tag Black Print |
| Rebuildable Stock | Trinity | Epic | TRI12001/TRI12002, CO27, Blue Can, 4x5 Ldn Br, 0.300 Com Armature Tag Green Print |
| Rebuildable Stock | Trinity | Epic | Epic X-EP1166 Black Can 2flats, laydown brush. 0.300 com Armature Tag Red Print |
| Non-Rebuildable Stock Motors | | | |
| Stock | Associated | Yokomo | Tru Stock R91 |
| Stock | Associated | Yokomo | Sonic R91 |
| Stock | Associated | Yokomo | Mach 1 R91 |
| Stock | GM Racing | Yokomo | GM9678 Purple Bull Stock w/ laydown br.+ full length arm R96 |
| Stock | GM Racing | Yokomo | GM9677 Purple Bull Stock w/ slotted arm ROAR 96 |
| Stock | GM Racing | Yokomo | Pinnacle 24 degree Stock #GM9680 R96 |
| Stock | Hobbico | Kyosho | # KYOG2700 Ion Storm R96 Stock |
| Stock | Hobbico | Kyosho | # KYOG2040 Sport Rcg R96Stock |
| Stock | Maxtec | Maxtec | Aftershock Stock R96 |
| Stock | Nomad Int'l | Sagami | Nexxus - Vented red can & endbell, slot arm, upright brush R91 |
| Stock | PTI/CAM | Sagami | Vortex VOR-0001 laydown brush, Blue endbell R91 |
| Stock | Race Prep | Race Prep | Orange Can R91 |
| Stock | Race Prep | Race Prep | Race Prep#RP-244 Hack Attack R91, R96 |
| Stock | Reedy | Yokomo | Reedy #300-001 R96 Stock |
| Stock | Reedy | Yokomo | Rage 24 degree, laydown brushes R96 |
| Stock | Trinity | Epic | Green Machine R91 |
| Stock | Trinity | Epic | Equalizer R91 |
| Stock | Trinity | Epic | Slot Mach II – laydown brush, Silver Can R91 |
| Stock | Trinity | Epic | Green Machine II R91 |
| Stock | Trinity | Epic | Midnight R 96 |
| Stock | Trinity | Epic | TM56/56A Silver can, Black endbell, laydown brush R96 |
| Stock | Trinity | Epic | TM56/TM56A X-Star R96 |
| Stock | Trinity | Epic | TM64 Midnight 2 Stock ROAR 98 |

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4.3.0 **Stock 17.5 Brushless Motors:** *General definition of a Brushless Motor:*

A Motor list will be compiled on a separate motor list (Stock & Super Stock Motor List)

4.3.1 No hybrid motors allowed. (Mixing of parts of brushless motors)

4.3.2 All brushless motors for the Stock class will be wind rating of 17.5 turns, clearly indicated by the manufacture on the external casing. Assembled motors will be inductance tested and all motors will read above the recommended inductance reading. If a motor fails this test, the rotor should be removed and a further inductance test will be carried out to ensure if the motor will be classified to pass or fail, and the rotor measured. All rotors should conform to rule 4.3.7.

UNI-T, model # UT602 inductance meter has been used to carry out testing

Minimum Readings: Assembled = 60 mH, Rotor removed = 90 mH

4.3.3 Sensored or Sensor-less motors are allowed.

4.3.4 The motor has to be re-buildable. Ball bearings are allowed.

4.3.5 If the motor is sensored, It Must use a six position JST ZH connector model number ZHR-6 or equivalent connector with 6 JST part number SZH-002T-P0.5 26-28 awg contacts or equivalent.

Wire sequence must be as follows:

Pin #1 - ground potential

Pin #2 - phase C

Pin #3 - phase B

Pin #4 - phase A

Pin #5 - temp control, 10 k Ohm Thermistor referenced to ground potential

Pin #6 - + 5.0 volts DC +/- 10%.

Compatible speed control must use the 6 position JST header part number X-6B-ZR-SMX-TF (where the X denotes the style of the header), or equivalent.

The power connector has to be clearly marked A, B, C.

A for phase A

B for phase B

C for phase C

4.3.6 **`05` size specifications**

Motor Can: Overall maximum diameter is 36.02mm measured at whatever point yields the maximum dimension, excluding solder tabs or lead wires. Overall minimum diameter is 34.00mm measured at whatever point yields the minimum dimension, excluding solder tabs or lead wires. Maximum length is 53.00mm measured from the mounting face of the motor to the furthest most point of the end bell, not including solder tabs, lead wires or original manufacturer's logo or name.

4.3.7 **Rotor:** Stock and Super Stock Motors: External shaft diameter must be 0.125 inches (3.175mm). Only one piece, two pole Neodymium sintered or bonded, or Ferrite (Ceramic) magnetic rotors are permitted. The magnet length shall be 25.0 +/- 1.00mm not including any non-magnetic balancing material. The magnet outside diameter shall be a minimum/maximum of 12.0-12.51 mm, no tolerances, for the entire length of the magnet. The shaft outside diameter, where the magnet is mounted, shall be 7.25 +/- 0.150mm. This dimension must be measurable without destroying the rotor.

4.3.8 **Stator, Stock Motor:** Only three slot "Y" wound stators are permitted. No delta wound or slot less stators are allowed. Only circular (round) pure copper magnet wire permitted. The three slotted stator must be wound with 17.5 turns of 2 strands of 20 AWG or 2 strands of 0.81 mm IEC per slot. The inductance for each slot of the stator shall be 100.00 Micro Henries minimum and 110.00 Micro Henries maximum, measured with the rotor removed from the motor.

4.3.9 All motors must have the original manufacturer's logo or name moulded into the end bell. A marking or unique feature that is difficult to remove must be integrated into the Stock and Super Stock motor to signify that it is for stock or super stock competition.

4.5.0 **540 Motors**

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- 4.5.1 Only an unopened Johnson 540 (silver end bell) motor is classed as Production Class.
- 4.5.2 No modifications are allowed. (Capacitors and Diodes may be used.)
- 4.5.3 Non-ferrous heats sinks are permitted.
- 4.5.4 The use of oil, cleaning fluids and motor sprays is permissible when applied before the race.
- 4.5.5 Performances enhancing motor accessories such as, torque rings, or on-board fluid systems, are not allowed whether fitted directly to the motor or to the car.
- 4.5.6 A free running motor must not exceed 17.500 RPM on an AARCMCC approved dyno.
- 4.5.7 All tests to be carried out us in a regulated 7.2v power supply capable of producing at least 5 amps, continuously. RPM reading to be taken using a plastic disc approx. 60mm x 0.5 mm thick supported on a separate ball-raced shaft and read with a digital optical tachometer.
- 4.5.8 At the Race Directors discretion, motors may be tested at the end of any heat. A maximum time of 15 minutes from the end of a heat will be allowed for a motor to cool. Motors must be allowed to cool naturally. The use of wet rags, water, ice, sprays, any lubricants etc., is not permitted.
- 4.5.9 Any motor exceeding specifications will result in the loss of that's heats results.
- 4.5.10 Any motor exceeding specifications in the Finals will result in disqualification from all three finals in the case of the A-final.
- 4.5.11 The use of Shellite or similar to run-in a motor is forbidden.
- 4.5.12 **The recommended brushless replacement for 540 will be 21.5 brushless motors as per the stock rules. It is also recommended that clubs discourage the use of expensive top end speed controls for this class.**

4.6.0 **19Turn Super Stock MOTORS**

- 4.6.1 Motors approved as 19Turn Super Stock motors must have the Manufacturer's name in the form of "XXXX 19" (e.g. EPIC 19, YOK 19, etc.) permanently stamped into the mounting face of the motor can. "XXXX 19" designates the use of the can for 19Turn "Super Stock" class racing. The manufacturer name on the can will make hybrid motors easy to identify.
- 4.6.2 All rebuildable 19Turn Super Stock motors may be either bearing- or bushing-type with an endbell that locks the timing at 24 degrees. The space between the magnets must be centered on one set of mounting holes, which will be marked on one side of the can to indicate zero degrees. The brush hoods will be aligned at 90 degrees from this mark, plus the allowed timing. The commutator slots must be aligned with the center of the individual poles. A two-degree tolerance will be allowed on the commutator, but not on the overall timing. Endbell must include a mark indicating 24-degree timing adjustment when motor is assembled. Only single-piece (two magnets in a can), or split (four magnets in a can) ceramic magnets are allowed. With single piece magnets, the center of each magnet must be 90 degrees from the 0 degree timing mark on the can. Split magnets must have the split in the segments centered at 90 degrees from the 0 degree timing mark on the can and all four segments must be of the same length. Offsetting single piece or split magnets with the intent of increasing motor performance/ timing is not allowed.
- 4.6.3 Endbell and can must be designed with a method of locking the timing at 24 degrees. This feature is in addition to any method that secures the endbell to the can (e.g., screws running through the side of the can). The endbell must incorporate a molded tab that keys into a slot on the can, locking the timing at 24 degrees. Endbell timing may only be set at 24 degrees. Extra locking devices (e.g., extra notches in the motor can that allow timing to be changed to 36 degrees or 5 degrees) are not allowed.

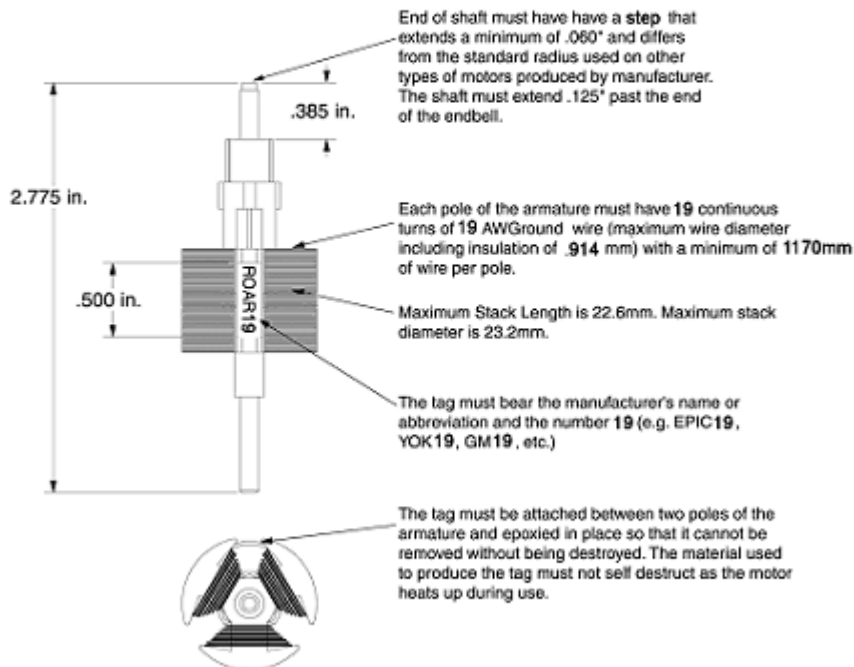
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- 4.6.4 Endbells may have inspection/cooling holes on each side between the negative and positive terminals. These holes would facilitate inspection of commutator tabs. Endbells must be marked with manufacturer's name.
- 4.6.5 The brush configuration may be of any type as long as that configuration appears on a previously ROAR approved modified or stock motor.
- 4.6.6 The motor can must have inspection holes/slots between magnet tips so that the armature may be viewed for inspection of armature tag (see 8.6.14). These holes/slots may be no closer than .220" from the top or bottom edge of the motor can. View through inspection holes/slots must not be obstructed by anything covering the holes/slots (e.g. motor label).
- 4.6.7 Magnets must be permanently glued to the motor can and may not be removed. No magnet shims are allowed (e.g., an extra shim that could be added on the end of the magnet or between the tips to change performance). Flux collector/timing rings are allowed as long as their only purpose is to secure the endbell to the motor can. Rings may not extend between magnet tips.
- 4.6.8 Rebuildable 19T "Super Stock" motor armatures must be machine-wound using a cross-wrap technique. **Armatures machine-wound using a hemi-wrap technique will be allowed beginning July 1, 2007.** The legal 19T "Super Stock" wind is a minimum of 1170mm of round 19 AWG (American Wire Gauge) wire, having a maximum wire diameter (including insulation) of .914mm, resulting in no less than 19 continuous turns of wire on each pole. There is no tolerance on the minimum length of wire, nor is there a plus tolerance allowed on the wire diameter.
- 4.6.9 Tabs on the armature's commutator may only be "compression welded". No after-market welding or silver brazing will be permitted. The Commutator must be locked to the armature laminations to prevent timing changes by twisting of the armature shaft.
- 4.6.10 Full stack armatures only are permitted made only of magnetisable materials. No split, skewed or tri-rotor armature stacks are allowed. Longitudinal slots parallel to the armature shaft in the pole crowns will not be allowed on any armature manufactured after January 1, 2002. The crowns of each armature pole must be symmetrical in cross section, with a constant crown radius. Steps in the crown or longitudinal holes in the crown are not allowed.
- 4.6.11 No modifications to the stack may be made other than the drilling of balancing holes. Modifications to the original OEM/Importer/Manufacturer configurations, including but not limited to excessive drill holes, milling or turning to lighten the armature or enhance the performance of the full stack are not allowed.
- 4.6.12 Armature must be tagged in a way that it is easy to identify both in and out of the motor. The tag must be permanently affixed to the armature and made of materials that will not self destruct from the heat of the motor or standard motor cleaning agents. The tag should be positioned between two poles of the armature and must be a minimum of .500" in length. The tag must be printed with the OEM manufacturer's name and "19" (e.g., "EPIC 19", "YOK 19", etc.).
- 4.6.14 Armature shaft must extend .125" beyond the endbell bushing/bearing when motor is assembled. The overall length of the armature shaft should be 2.775" with .385" extending beyond the end of the commutator. The commutator end of armature shaft must have a machined "step" that differs from the standard radius or taper currently used by OEM manufacturers in production of other stock or modified motors. The step should continue for a minimum of .060" from the end of the shaft.
- 4.6.15 No modifications to the physical construction of the motor can, endbell, or armature will be permitted (e.g. adding or removing material from the armature stack, changing the brush hoods from stand up to lay-down and visa-versa, relocating spring posts). If a motor shows signs of tampering during post race inspection, the driver will receive no score for that qualifier or main.
- 4.6.16 Epoxy balancing of armatures for rebuildable 19Turn Stock motors will not be permitted. No more than two balancing holes are permitted on any two-pole faces (the third face may not have more than one hole).

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- 4.6.17 The armature, motor can, and endbell of a rebuildable 19Turn Super Stock motor must all be from the same motor manufacturer and can contain only components from the same model. No hybrid motors or mixing of parts from different models will be permitted.

19T "SUPER-STOCK" MOTOR ARMATURE



4.7.0 **Super Stock 10.5 Brushless Motors:** *General definition of a Brushless Motor:* *A Motor list will be compiled on a separate during 2008(Stock & Super Stock Motor List)*

- 4.7.1 No hybrid allowed. (mixing of parts of brushless motors)
- 4.7.2 All brushless motors for the Superstock class will be wind rating of 10.5 turns, clearly indicated by the manufacture on the external casing. Assembled motors will be inductance tested and all motors will read above the recommended inductance reading. If a motor fails this test, the rotor should be removed and a further inductance test will be carried out to ensure if the motor will be classified to pass or fail and the rotor measured. All rotors should conform to rule 4.7.7.
UNI-T, model # UT602 inductance meter has been used to carry out testing
Minimum Readings: Assembled = 24 mH, Rotor removed = 35 mH.
- 4.7.3 Sensored or sensor-less motors are allowed.
- 4.7.4 The motor has to be re-buildable. Ball bearings are allowed.
- 4.7.5 If the motor is sensored, It Must use a six position JST ZH connector model number ZHR-6 or equivalent connector with 6 JST part number SZH-002T-P0.5 26-28 awg contacts or equivalent.
Wire sequence must be as follows:
Pin #1 - ground potential
Pin #2 - phase C

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Pin #3 - phase B

Pin #4 - phase A

Pin #5 - temp control, 10 k Ohm Thermistor referenced to ground potential

Pin #6 - + 5.0 volts DC +/- 10%.

Compatible speed control must use the 6 position JST header part number X-6B-ZR-SMX-TF (where the X denotes the style of the header), or equivalent.

The power connector has to be clearly marked A, B, C.

A for phase A

B for phase B

C for phase C

4.7.6 **`05` Motor size specifications**

Motor Can: Overall maximum diameter is 36.02mm measured at whatever point yields the maximum dimension, excluding solder tabs or lead wires. Overall minimum diameter is 34.00mm measured at whatever point yields the minimum dimension, excluding solder tabs or lead wires. Maximum length is 53.00mm measured from the mounting face of the motor to the furthest most point of the end bell, not including solder tabs, lead wires or original manufacturer's logo or name.

4.7.7 **Rotor:** Stock and Super Stock Motors: External shaft diameter must be 0.125 inches (3.175mm). Only one piece, two pole Neodymium sintered or bonded, or Ferrite (Ceramic) magnetic rotors are permitted. The magnet length shall be 25.0 +/- 1.00mm not including any non-magnetic balancing material. The magnet outside diameter shall be a minimum/maximum of 12.0-12.51 mm, no tolerances, for the entire length of the magnet. The shaft outside diameter, where the magnet is mounted, shall be 7.25 +/- 0.150mm. This dimension must be measurable without destroying the rotor.

4.7.8 **Stator, Super Stock Motor:** Only three slot "Y" wound stators are permitted. No delta wound or slot less stators are allowed. Only circular (round) pure copper magnet wire permitted. The three slotted stator must be wound with 10.5 turns of 2 strands of 24 AWG or 2 strands of 0.51 mm IEC per slot. The inductance for each slot of the stator shall be a minimum of 30.00 Micro Henries minimum, measured with the rotor installed in the motor.

4.7.9 All motors must have the original manufacturer's logo or name moulded into the end bell. A marking or unique feature that is difficult to remove must be integrated into the Stock and Super Stock motor to signify that it is for stock or super stock competition.

4.7.10 All brushless motors for the Stock class will be restricted to a minimum wind rating of 10.5 turns, clearly indicated by the manufacture on the external casing. Motors will be tested through an inductance test and all motors will read above the recommended inductance reading to be listed for each brand. If a motor fails this test, the rotor should be removed and a further inductance test will be carried out to ensure if the motor will be classified to pass or fail

9.0.0 **Batteries**

Only Batteries that appear on the AARCMCC, IFMAR, ROAR EFRA & BRCA approved battery list may be used.

1/12th scale a maximum of 4 cells (4.8 volt rating), or 1 cell LiPo (3.7 volt rating)

All other classes of electric cars must use a maximum of 6 cells NiMh, NiCd or 2 cell 7.4 volt LiPo.

Batteries Technical: NiCd & NiMh

9.1.1 Nickel Cadmium or Nickel Metal hydride construction cells must be sub-C size, rated nominally at 1.2 volts per cell. Cell dimensions should not exceed length of 44 mm and diameter of 23 mm with heat shrink fitted. Maximum Rating of 5500 Mah.

9.1.2 The heat shrink must clearly show the manufactures identification of the cell and show no signs of tampering. Cells with no clear external manufactures identification are not allowed for use at AARCMCC events.

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- 9.1.3 No modifications allowed to the outer or inner cell construction or modifications to the chemical composition.
- 9.1.4 Soldering for connections and wire is allowed.
- 9.1.5 The Organiser and AARCMCC Officials may check the legality of a competitor's cells at any time during a sanctioned event.
- 9.1.6 A weight scale will be available at all times during the event for competitors to carry out weight checks on cells.
- 9.1.7 Cells may not be charged or changed during the race.
- 9.1.8 An additional battery pack to power the radio system and transponder only is allowed.
(Radio Receiver Pack)
- 9.1.9 Batteries of all A-finalists may be checked for capacity and the results made available for all.

Batteries Technical: LiPo (*Lithium Polymer*)

- 9.2.0 Approved Lithium Polymer batteries only as per current IFMAR, BRCA, ROAR & EFRA web site listings.
Batteries must be factory sealed in a hard case that can withstand impacts as per IFMAR, BRCA, ROAR & EFRA testing procedures,
No soft cased Lipo batteries allowed (for car battery)
No modifications are allowed to the case and/or the battery, any physical distortion, denting, split seams, puncturing or other damage to the hard case of the Lipo battery will deem the battery to be ineligible for use. Lithium Polymer batteries are to be hard cased, rated voltage of 3.7 volts per cell and a maximum discharge rating of 5500 Mah. Batteries must be approved by IFMAR, BRCA, EFRA, ROAR battery listings.
Distributors can apply to AARCMCC for Australian certification under specific conditions.

9.2.1 **General Specifications**

Nominal capacity must not exceed 3.7v/cell - 5500mah.
Full charge voltage not to exceed 4.2 volts + 0.2 volts per cell.
Minimum rating of 20C

Physical Dimensions:

Straight pack configuration

Length: 139 mm +0mm/-3mm
Width: 47 mm +0mm-2mm
Height: 24 mm +0mm/-3mm

Saddle pack configuration

Length: 70 mm +0mm/-3mm
Width: 47 mm +0mm-2mm
Height: 24 mm +0mm/-3mm

9.2.3 **Procedures for Charging and Use**

Whilst charging and/or discharging, batteries must be contained in a Lipo sack or other device (fire mitigation device able to withstand and contain a destructive failure without showing a flame)
Electronic speed controls are to have either an inbuilt or an external cut-off electronic device installed that will not allow the battery to discharge below 6 volts minimum.
Lipo capable chargers are only to be used; it is recommended that Lipo batteries are charged at a maximum charge rate of 1C.
Overcharging is not allowed (voltage higher than 8.4v +/-0.04V)

Batteries that are showing signs of failure from use, should be isolated from the immediate area of human and animal contact, and preferably contained in a Lipo sack or other device that will contain a destructive failure.

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9.2.4 **Tech Inspection guidelines**

Disqualification will result if any of the three charging guidelines is breached

- 1.) Charging the Lipo pack with anything but a charger capable of the standard Lipo CC/CV charging method.
- 2.) Charging a Lipo pack to a voltage higher than 8.40V +/-0.04V
- 3.) Charging a Lipo pack outside of a “Lipo sack” or other device proven to contain a destructive failure of a Lipo pack.

Further

This rule will be implemented for all classes

Weight limits for all classes and divisions to remain the same so as not to give an unfair advantage to Lipo users